

CLAIMS

We claim:

1. A motor comprising:

a means for actuating a radial wave, said means having an outer boundary surface that exhibits the actions of said radial wave, said means also having a central axis from which said radial wave action is directed,

a deformable flexspline having an inner surface and a toothed outer surface, said flexspline coaxially aligned with the central axis of said means and oriented such that flexspline inner surface is proximate the outer boundary surface of said means, said flexspline toothed outer surface having a first specified number of teeth,

a circular spline having a toothed inner surface, said spline having an outer boundary surface and being coaxially aligned with said central axis and oriented such that said spline toothed inner surface is proximate the toothed outer surface of said flexspline, said spline inner surface having a second specified number of teeth which is different than said first specified number of teeth in said flexspline,

wherein said means is operable so that the action of said radial wave causes at least one of said deformed flexspline teeth to engage at a point the toothed side of said circular spline in such a manner that said engagement point passes as a wave around the inner perimeter of said circular spine, said movement of said engagement point causing said flexspline to rotate around said central axis.

2. A motor as recited in claim 1, wherein:

said radial wave actuating means comprising a centrally located, rotatably mounted, elliptical ring having an outer boundary surface, a plurality of pistons, each having a piston cylinder and a rod extending from said cylinder, said pistons located proximate said spline outer surface and oriented so that said rods are radially aligned with respect to said central axis, each of said rods having an end that contacts a point on said ring outer surface,

wherein said pistons are sequentially operable so that the action of said rod ends on said ring causes said ring to rotate about its central axis in such a manner that at least one of said deformed flexspline teeth engages at a point the toothed side of said circular spline in such a manner that said engagement point passes as a wave

1 around the inner perimeter of said circular spine, said movement of said engagement
2 point causing said flexspline to rotate around said central axis.

3 3. A motor as recited in claim 2 wherein the teeth of said spline and flexspline are
4 configured so that the angular distance of said flexspline rotation for a single
5 revolution of said ring is a function of the difference in said specified number of teeth
6 in said flexspline and spline.

7 4. A motor as recited in claim 3 further comprising:

8 an annular bearing having an inner and an outer race, wherein said inner race
9 is proximate said ring outer surface and said outer race is proximate said flexspline
10 inner surface, and

11 wherein, with said bearing so situated, said piston rod ends are contacting
12 points on said bearing outer race.

13 5. A motor as recited in claim 1, wherein:

14 said radial wave actuating means comprising a centrally located platform
15 having a center point and an outer boundary surface, a flexible ring surrounding said
16 platform, said ring having an inner and an outer surface, said ring coaxially aligned
17 with said platform center point, a plurality of force applying means, each having a
18 fluid containing diaphragm and a force applying diaphragm surface, each of said
19 means located in a spaced-out relationship around the perimeter of said platform and
20 oriented so that said force applying diaphragm surface is radially aligned with respect
21 to said platform center point, each of said force applying diaphragm surfaces
22 contacting a point on said flexible ring inner surface.

23 6. A motor as recited in claim 5 wherein the teeth of said spline and flexspline are
24 configured so that the angular distance of said flexspline rotation for a single cycle of
25 the sequential operation of said force applying means is a function of the difference in
26 said specified number of teeth in said flexspline and spline.

27 7. A motor as recited in claim 1, wherein:

28 said radial wave actuating means comprising a centrally located fluid
29 containing, flexible, wave generator ring having a center point and an outer boundary
30 surface, wherein said ring capable of being deformed by the movement of said
31 contained fluid so that ring boundary surface takes the form of an ellipse having a

1 major and a minor axis, with said axis being capable of being caused to rotate around
2 said ring center point by specified movement of said contained fluid,

3 wherein said wave generator ring being deformed by specified motion of
4 contained fluid so that a portion of its outer, boundary surface contacts the inner
5 surface of said flexspline so as to cause said flexspline to deform in such a manner
6 that at least one of said deformed flexspline teeth engages at a point the toothed side
7 of said circular spline in such a manner that said engagement point passes as a wave
8 around the inner perimeter of said circular spine, said movement of said engagement
9 point causing said flexspline to rotate around said ring center point.

10 8. A motor as recited in claim 7 wherein the teeth of said spline and flexspline are
11 configured so that the angular distance of said flexspline rotation for a single cycle of
12 the rotation of said ellipse of said wave generator ring is a function of the difference
13 in said specified number of teeth in said flexspline and spline.

14 9. A motor as recited in claim 7 wherein said wave generator ring having an inner
15 membrane, a plurality of spaced-apart, deformable lobes attached to said membrane, a
16 plurality of inflatable cylinders oriented so that one of said cylinders lies between
17 each of said spaced-apart lobes, wherein each of said lobes having a distal surface and
18 wherein said distal surfaces configured so as to generally form a segmented, circular,
19 cylindrical, boundary surface that is proximate said flexspline inner surface.

20 10. A motor as recited in claim 9 further comprising a plurality of fluid conduits that
21 connect the pairs of adjoining, inflatable cylinders that are located on the opposite
22 sides of said segmented, circular, cylindrical, boundary surface so that said connected
23 cylinders can be simultaneously inflated so as to cause an increase in the distance that
24 separates the segments of said boundary surface of said adjoining lobes.

25 11. A motor as recited in claim 10 further comprising a pump for sequentially
26 inflating said pairs of adjoining, inflatable cylinders.

27 12. A motor as recited in claim 1, wherein:

28 said radial wave actuating means comprising a central ring having an outer,
29 boundary surface and a center point, a plurality of diaphragm pistons, each having a
30 fluid containing cavity, a diaphragm that covers said cavity and a top action surface,
31 said pistons being mounted along the perimeter of said ring boundary surface so that

1 said action surfaces move radially from said ring center point as the amount of fluid
2 in said cavities is increased, a planetary gear having an inner surface and a toothed
3 outer surface with a first specified number of teeth, said planetary gear having a center
4 point that coincides with said ring center point, a wave generator gear having an outer
5 surface and a toothed inner surface and oriented such that said wave generator toothed
6 inner surface is proximate the toothed outer surface of said planetary gear, said wave
7 generator gear having a second, specified number of teeth which is different than said
8 first specified number of teeth in said planetary gear, and a ring bearing having an
9 outer surface and an inner surface, said bearing inner surface being proximate said
10 wave generator gear outer surface.

11 13. A motor as recited in claim 12 wherein, by a specified flow of fluid through said
12 pistons, the outer boundary surface of said planetary gear is so configured so as to be
13 caused to move relative to said ring center point so that a portion of said planetary
14 gear outer surface contacts the inner surface of said wave generator gear in such a
15 manner that at least one of said planetary gear teeth engages at a point the toothed side
16 of said wave generator gear in such a manner that said engagement point passes as a
17 wave around the inner perimeter of said wave generator gear, said movement of said
18 engagement point causing said wave generator gear to rotate around said ring center
19 point.

20 14. A motor as recited in claim 13 wherein said flexspline and spline so configured
21 so that rotational motion of said wave generator gear causes said flexspline to deform
22 in such a manner that at least one of said deformed flexspline teeth engages at a point
23 the toothed side of said circular spline in such a manner that said engagement point
24 passes as a wave around the inner perimeter of said circular spine, said movement of
25 said engagement point causing said flexspline to rotate around said ring center point.

26 15. A rotary motor comprising:

27 a central ring having an outer, boundary surface and a center point,
28 a plurality of diaphragm pistons, each having a fluid containing cavity, a
29 diaphragm that covers said cavity and a top action surface, said pistons being
30 mounted along the perimeter of said ring boundary surface and configured so that said

1 action surfaces move radially from said ring center point as the amount of fluid in
2 said cavities is increased,

3 a planetary gear having an inner surface and a toothed outer surface with a
4 first specified number of teeth, said planetary gear having a center point that coincides
5 with said ring center point,

6 an inner gear having an outer surface and a toothed inner surface and oriented
7 such that said inner gear toothed inner surface is proximate the toothed outer surface
8 of said planetary gear, said inner gear having a second, specified number of teeth
9 which is different than said first specified number of teeth in said planetary gear,

10 a ring bearing having an outer surface and an inner surface, said bearing inner
11 surface being proximate said inner gear outer surface,

12 wherein by a specified flow of fluid through said pistons the outer boundary
13 surface of said planetary gear is caused to move relative to said ring center point so
14 that a portion of said planetary gear outer surface contacts the inner surface of said
15 inner gear in such a manner that at least one of said planetary gear teeth engages at a
16 point the toothed side of said inner gear in such a manner that said engagement point
17 passes as a wave around the inner perimeter of said inner gear, said movement of said
18 engagement point causing said inner gear to rotate around said ring center point.

19 16. A method of providing a rotary motor:

20 utilizing a means for actuating a radial wave, said means having an outer
21 boundary surface that exhibits the actions of said radial wave, said means also having
22 a central axis from which said radial wave action is directed,

23 utilizing a deformable flexspline having an inner surface and a toothed outer
24 surface, said flexspline coaxially aligned with the central axis of said means and
25 oriented such that flexspline inner surface is proximate the outer boundary surface of
26 said means, said flexspline toothed outer surface having a first specified number of
27 teeth,

28 utilizing a circular spline having a toothed inner surface, said spline having an
29 outer boundary surface and being coaxially aligned with said central axis and oriented
30 such that said spline toothed inner surface is proximate the toothed outer surface of
31 said flexspline, said spline inner surface having a second specified number of teeth,

1 wherein said means is operable so that the action of said radial wave causes at
2 least one of said deformed flexspline teeth to engage at a point the toothed side of said
3 circular spline in such a manner that said engagement point passes as a wave around
4 the inner perimeter of said circular spine, said movement of said engagement point
5 causing said flexspline to rotate around said central axis.

6 17. A method as recited in claim 16,

7 wherein said radial wave actuating means comprising a central ring having an
8 outer, boundary surface and a center point, a plurality of diaphragm pistons, each
9 having a fluid containing cavity, a diaphragm that covers said cavity and a top action
10 surface, said pistons being mounted along the perimeter of said ring boundary surface
11 so that said action surfaces move radially from said ring center point as the amount of
12 fluid in said cavities is increased, a planetary gear having an inner surface and a
13 toothed outer surface with a first specified number of teeth, said planetary gear having
14 a center point that coincides with said ring center point, a wave generator gear having
15 an outer surface and a toothed inner surface and oriented such that said wave
16 generator toothed inner surface is proximate the toothed outer surface of said
17 planetary gear, said wave generator gear having a second, specified number of teeth
18 which is different than said first specified number of teeth in said planetary gear, and
19 a ring bearing having an outer surface and an inner surface, said bearing inner surface
20 being proximate said wave generator gear outer surface.

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